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CENTRAL AMERICAN STONEFLIES, WITH DESCRIPTIONS OF NEW SPECIES (PLECOPTERA)

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This paper is a re-characterization of the old species of stoneflies from Central America and Mexico, together with descriptions of a few new ones. Since the publication of Pictet's *Hist. Nat. Neuropt: Perlides* in 1842 there has been hardly any progress in the knowledge of this fauna. The sketchy colored figures of Pictet's plates, while of some assistance in the recognition of species, do not show the characters in venation and in genitalia that have since come to be regarded as truly diagnostic; nor do the descriptions mention these characters. Moreover, all the known species of this entire region belong to a single genus that has never been adequately characterized or illustrated.

When the Neuroptera volume of *Biologia Centrali Americana* was issued, the senior author, then being interested in stoneflies, wrote Mr. Godman asking whether any had been collected for this great work, none being mentioned in it. In reply Mr. Godman sent a small box of them, saying that no one had been found to work them up for that publication. He suggested that the inquirer work them up at his convenience, publishing where he pleased, and making whatever disposition he pleased of the specimens.

The box contained a score or more of pinned specimens. They were a sorry looking lot—even worse bedraggled, shrivelled and faded than the average collection of pinned stoneflies. Aside

from a few notably large specimens and one notably small one, they all looked alike superficially; and when one examined the shrunken genitalia, no two of them looked alike!

No opportunity for doing the work required for a proper study of this collection came until recently, when the junior author joined in the undertaking.

We have been able to identify nearly all the regional species of the older authors and to characterize both sexes of several of them (though in our collections females are more abundant), and to describe the nymph and the egg as well.

All the stoneflies of this region appear, singularly enough, to belong to a single genus,* *Anacroneuria*. This genus was proposed by Klapalek in 1909 (*Wiener Ent. Zeitung* 28: 227-8). It was based largely on genital characters of the male which have not been hitherto illustrated nor adequately described. Klapalek laid stress upon the presence of a percussion disc on the prolonged ninth ventral segment of the male, but that has proved of minor importance, being lacking in at least one species (*A. dilaticollis*). The upturned subgenital hooks developed from the subanal plates are however a much better character.

The genus is well marked by three characters that will apply to both sexes:

1. Two ocelli.
2. The sinuate course of the second anal vein, at first approximated to the first anal, then diverging from it and thereafter pectinately branched and not connected with the third anal by a crossvein.
3. The basal cubito-anal crossvein in the fore wing when developed, is situated well beyond the anal cell.

The genus is dominant throughout the Neotropical Region. A very large number of species have been described from South America by Enderlein and Klapalek. It will be no easy task to identify them: for Klapalek has given no illustrations of any

* *Perla aurantiaca* Hagen was put by its describer in the "subgenus Isogenus" (*Synops. Neur. N. Amer.*, p. 19, 1861) because of four upcurving branches to the radial sector; but its lack of a median ocellus excludes it from Isogenus and allies it, also, with *Anacroneuria*.

of his new species and has not even stated the sex on which some of his descriptions are based; and Enderlein's small outline figures of female subgenital plates show such slight differences as can hardly be of specific value. The edge of this plate varies in form and is subject to great distortions in drying.

All of the specimens on which this paper is based are in the Cornell University collection. Three of the described regional species remain unknown to us: *Perla aurantiaca* Hagen mentioned in a preceding footnote, *Neoperla gautemalensis* Enderlein and *Perla litura* Pictet, which last we think may be a synonym of the very variable *Perla dilaticollis* Burmeister. The remaining species, including the new ones, may be separated as follows:

KEY TO SPECIES OF CENTRAL AMERICAN AND MEXICAN ANACRONEURIA

- 1.—Femora black and yellow, the color areas sharply delimited..... 2
—Femora brownish or paler with darker areas ill defined or wanting... 3
- 2.—Prothorax black..... *aethiops*
—Prothorax yellow..... *naomi*
- 3.—Tails ringed..... *annulicauda*
—Tails not ringed..... 4
- 4.—Head with a sharply defined quadrangular black spot above including the ocelli..... *blanda*
—Head pale or diffusely blackened over the ocelli..... 5
- 5.—Head black-bordered above, with a large oval yellow crown spot including the ocelli; wings dark brown..... *coronata*
—Head not so, middle area darker; wings yellowish..... 6
- 6.—Subgenital plate of females rather squarely truncate, with a small median notch..... 7
—Subgenital plate of female four-lobed..... 8
- 7.—Large species; fore wing 18 mm. (♀)..... *cincta*
—Smaller species; fore wing 11–13 mm. (♀)..... *dilaticollis*
- 8.—Inner pair of lobes on apex of subgenital plate of female, broad and ill defined..... *nigrocincta*
—Inner pair of lobes on apex of subgenital plate of female, small but well defined..... *sulana*

Anacroneuria annulicauda Pictet

1842. *Perla annulicauda* Pict. Perlides, p. 249, Pl. 22, fig. 1–4.
1852. *Perla annulicauda* Walker, Catalog, p. 160.
1861. *Perla annulicauda* Hagen, Syn. Neur. N. A., p. 26.
1909. *Neoperla annulicauda* Enderlein, Sitzb. Natur. Freunde, p. 175, fig. 8.

This species may be designated as the type of the genus. Our material comes from Brazil. We have none from Mexico, whence others have reported it. We have seen no male of the species, but are able to present a fuller characterization of the female than has hitherto been available.

Color tawny yellowish. Head obscure brownish above, darker before the ocelli and on the lappets that overlie the bases of the antennæ. Palpi brownish; antennæ brownish beyond the pale basal segment, becoming somewhat paler toward their tips.

Prothorax rather uniform tawny yellow, hardly paler in the median area of the disc and along its lateral margins. The side margins of the disc are at first parallel and then strongly convergent posteriorly to the hind margin. Wings tawny, subhyaline, with somewhat darker veins. Legs yellowish, only the narrow transverse knee caps and the tarsal pulvilli brown.

Abdomen tawny; tails brownish, annulate with paler on the small basal divisions of the segments; the extreme base yellowish. The subgenital plate of the female is four-lobed; the tips of the smaller lobes of the inner pair are divergent; on the slightly produced and bilobed ninth segment are three patches of spinules, a larger pair on the lobes and a smaller one of finer spinules on the median line between the others (Fig. 1). The egg is of the usual oval form, with a low button-shaped micropylar cap upon the larger end.

Length of fore wing 17 mm. Rio Brazil.

Anacroneuria sulana new species.

Color dull yellowish varied with obscure brownish. Antennæ brown including the basal segment. Maxillary palpi brown; labial palpi paler. Head yellow, with a median brownish streak joining two brownish cross-bars, the anterior one ending on the lappets that cover the bases of the antennæ, the posterior broader one enveloping the ocelli and tubercles and extending to the inner margin of the eyes. Rear of head yellow.

Prothorax pale brownish, with a narrow black marginal line across the front, two broad yellowish longitudinal stripes upon the disc, separated by a narrower brownish middorsal stripe. This median stripe is in turn divided by a very narrow median pale line. The width of the prothorax is nearly twice its length, and the straight sides strongly converge toward the rear margins. Wings subhyaline, tawny yellow, with somewhat darker veins. Legs tawny or pale brown with blackish knee caps. The tips of the last tarsal segment including claws and pulvilli also are blackish. Base of legs

yellow as far out as the middle of the femora on the front legs and almost to the knees on the hind legs.

Abdomen tawny yellowish. Tails pale brownish, yellowish at base. Subgenital plate of the female four-lobed, the inner pair of lobes minute and apparently rather variable in form (see figs. 2 and 2A). The median area of the ninth sternite has a bare spot on its apical margin in the midst of its field of spinules. The eggs of this species are shown in fig. 3B.

TYPE. A female from Rio Santa Ana, British Honduras, collected by Karl P. Schmidt (Fig. 2). The female whose plate is shown in Fig. 2A is in the Godman collection from Paso del Macho. In the same collection are two other females, one from Chinadaga, and one from Sula.

Anacroneuria nigrocincta Pictet

1842. *Perla nigrocincta* Pict. Perlides, p. 236, pl. 22, figs. 508.

1852. *Perla nigrocincta* Walker, Catalog, p. 158.

1861. *Perla nigrocincta* Hagen. Synops. Neur. N. A., p. 24.

Very variable in size, the length of fore wing ranging from 11 mm. and 12 mm. in the smallest males to 18 mm. in the largest females.

Color obscure tawny brownish, little varied. Head brown above with a round median pale spot replacing the middle ocellus. A paler area between ocellus and eyes extends around behind the eye to the hind angle of the head. Antennae brown except the paler basal segment. In boiled specimens the joinings between segments are paler, giving the whole organ a narrowly ringed appearance. Palpi brown.

The prothoracic disc is obscurely striped having border of brown, then two paler lateral stripes and then a median stripe of brown that is divided longitudinally by a fine pale line. The thin sharp edges are strongly convergent backward and the front angles in the female appear to be obliquely truncated. Wings subhyaline tawny yellowish, with somewhat darker veins. Legs yellow with black knee caps; a wash of brown extends obliquely inward therefrom half the length of the femur, and wholly covers the tibia externally, and also the last joint of the tarsus.

Abdomen tawny yellow. Tails brownish. The ninth sternite of the male is produced backward in a rounded lobe half the

length of the tenth segment and bears beneath a bare nipple-shaped hammer near its apex (Fig. 3). The tips of the hooks formed by upcurving subgenital plates are obliquely eroded, with a pair of sickle-shaped tenacula near its tip whose apices lie superposed.

The subgenital plate of the female is obscurely four-lobed; the inner lobes are low and broad, and the outer ones are longer. At their outer edges they are variously infolded in different specimens, presenting variety of aspect (Fig. 3A, B). The median area of the ninth sternite is well covered with convergent spinules.

This species appears to be of general distribution. It is well represented by specimens of both sexes, in the Godman collection. The localities are as follows:

Mexico	Nicaragua
Atoyac, ♂ and ♀	Chontales, ♂
Capetillo, ♂	Costa Rica
Chiapas, ♂	Irazu, ♂
Chilpancingo, ♂	Honduras
Cuernavaca, ♂	Rio Santa Ana, ♂
Cuidad, ♀	Rio de Janeiro.
Orizaba, 4 ♂ s	Chapada.
Pancina, ♂ and ♀	
Rinco, ♀ s	
Guatamela	
Duenas, ♀	
Purula, ♂ and ♀	
Zapote, ♂ and several ♀ s	

A female of what appears to be another allied species from Chapada is represented in figure 3A. It is a defective specimen inadequate for description. Another similar female, likewise defective, comes from Chapada. Both are in the Godman collection.

Anacroneuria cincta Pietet

1842. *Perla cincta* Piet. Perlides, p. 227, pl. 20, fig. 5.
 1852. *Perla cincta* Walker. Catalog. B. M., p. 156.
 1861. *Perla cincta*. Hagen. Synops. Neur. N. A., p. 24.

Length of fore wing, 18 mm. ♀

Color tawny yellow varied with brown. Head brownish above with a very obscure pale transverse M-mark in front of the ocelli, and a paler area encircling the ocelli except in front and extending laterally almost to the hind angles. The eyes are bordered with brown. Antennae blackish, including the basal segment. The joinings are paler in the boiled specimens, giving a narrowly ringed appearance to the flagellum. Palpi brown.

Prothorax widest in the middle, narrowed thence slightly forward and strongly to rearward. In the color it is longitudinally striped with lighter and darker brown. The darker predominates except in the median area where a pair of brown stripes are narrowly separated by a paler one: they are bordered laterally by broader paler ones. On the sides of the disc there are some obscure embossed markings and there is a diffuse paler area adjacent to each anterior angle. The wings are tawny yellowish subhyaline, with darker veins. The legs are pale brownish with black knee caps. The tips of the tibiae and the last segment of the tarsi are darker brown.

The abdomen is pale brownish, with tails of the same color. The subgenital plate of the female overlaps about half of the ninth sternite below, is rather squarely truncate, and has in the middle an acute notch. The shield-shaped spinulose area of the ninth sternite occupies the middle third of its breadth except for a small median apical bare patch (Fig. 4). It forms a broad T in outline by reason of a narrow stalk-like extension proximally, but the stalk of the T is overlapped by the subgenital plate and is not visible externally.

Three female specimens only, all from the Godman collection; one labeled "Cerro Zonil, 4-5000 ft., Champion"; the other two from Chiriqui.

Anacroneuria naomi new species.*

Length of fore wing 22 mm. ♀.

A large brownish species with yellow prothorax and banded legs. Head brownish, darkest in the middle, with pale M-mark in front and pale vertical tubercles that are transversely elongated and twice as long as wide. Lappets overlying the bases of the antennae blackish; the area between them

* Named in honor of Mrs. Naomi George Argo, who helped us efficiently in the preparation of the dried specimens of the Godman collection for study.

at the front pale. Antennæ lacking except the two basal segments which are blackish. Palpi brown.

The prothoracic disc is one-half wider than long. It is wholly yellow, a little darkened toward the sides in a pair of broad diffuse, obscure, longitudinal streaks, between the pale yellow of the middle area and the lateral margins. Wings (Fig. 6A) tawny, subhyaline, with somewhat darker veins, and a more yellowish tint on the coastal margin. Legs of the last pair (these only present) bright yellow basally, black beyond the second third of the femur.

Abdomen brownish, yellowish beneath. Tails brownish, densely clothed with short spinules. Subgenital plate of female truncate, acutely notched in the middle, with a mere suggestion of a second notch each side. The ninth sternite has a median area beset with stiff convergent spinules (Fig. 6).

Described from a single female of the Godman collection bearing the label "Senahu, Vera Paz, Champion." The legs are like those of *A. aethiops*, and we at first thought it might be a defectively colored specimen of that species, but the shape of prothorax is different, that of *A. aethiops* being twice as wide as long, and the subgenital plate and ninth sternite of the female are narrower.

Anacroneuria aethiops Walker

1852. *Perla aethiops* Walker. Catalog. B. M., p. 154.

1861. *Perla aethiops* Hagen. Synops. Neur. N. A., p. 24.

Length of fore wing 18–20 mm. ♀.

This is a big black species with banded legs. Head above mostly blackish, darkest between the ocelli and on the lappets that overlie the base of the antennæ, but yellowish at the sides both before and behind the eye and along a narrow line bordering the eye internally. Antennæ and palpi black.

Prothorax black above, quadrangular, twice as wide as long. Wings blackish, subhyaline between the darker veins. Legs black and yellow, the colors sharply and squarely delimited. Coxa, trochanter and basal two-thirds of femora bright yellow; remainder black.

Abdomen blackish, tails blackish, a little paler at the very base. Subgenital plate of female shield-shaped, truncate, with a shallow middle emargination and a suggestion of two others at the sides. The spinulosa middle area of the ninth sternite is broadly shield-shaped and margined with spinules in a close set series.

Two females are in the Godman collection from Chiapas.

Anacroneuria blanda new species.

Length of fore wing 13 mm. ♀.

Color yellowish varied with brown. Head yellow, with a large dark brown quadrangular crown spot covering the ocelli, the sides of this spot emarginate as shown in figure 9. The lappets that overlie the base of the antennae and the side margins of the head behind the eyes also are brown. Antennae and maxillary palpi brown, somewhat paler at base; labial palpi yellowish.

Prothorax wider than long, broadest in front with sides convex and converging to rearward. Its disc bears a median yellow stripe and a pair of lateral brownish ones. Meso- and metathorax pale dorsally except for a wash of brown beside the fore wing roots. Wings smoky hyaline with brown veins, becoming suffused with brown along veins Sc and R in the fore wing and along the stigma in both wings. In front of this the costa is yellowish. Legs yellow and brown, the yellow restricted to the basal half of the femora and the middle of the tibiae, and being more extensive on hind than on fore legs.

Abdomen and tails yellow, the latter soft pilose. Subgenital plate of female, divided by an acute notch into two broadly rounded lobes and followed by spinulose tracts on both the ninth and tenth sternites (Fig. 9A).

TYPE, a single female specimen collected by Dr. W. C. Allee on Barro Colorado Island, Gatun Lake, Panama.

Anacroneuria coronata new species.

Length of fore wing 10 mm. ♂.

A small blackish brown species with iridescent wings and a large yellow crown spot covering most of the head. Antennae and palpi brown. Head brown only at sides and rear, this color behind just touching and not enveloping the ocelli.

Prothorax brown with a yellow median band. The sides of the disc are parallel half way and then strongly convergent to the head margin. The wings are wholly brown, shining and iridescent, with black veins (Fig. 7A). In the expanded anal area of the hind wings the cells are fenestrate by reason of a more hyaline central area in each, whose breadth is about equal to that of the darker membrane bordering the veins. Legs all brown beyond the trochanter.

Abdomen brown: tails yellow. The prolonged ninth sternite of the male bears beneath a distinct nipple-shaped percussive disc or hammer (Fig. 7).

TYPE, a single male in the Cornell University collection bearing the label "Mexico, Sallee."

This is allied to the *Perla morio* Pictet from Colombia.

Anacroneuria dilaticollis Burmeister.

1839. *Perla dilaticollis* Burm. Handb. Ent. 2: 880.

1842. *Perla dilaticollis* Pict. Perlides, p. 240, pl. 23, fig. 5-10.

1852. *Perla dilaticollis* Walk. Catalog. B. M., p. 158.

1861. *Perla dilaticollis* Hagen. Synops. Neur. N. A., p. 25.

Length of fore wing, ♂ 7 to 10 mm.; ♀ 11 to 13 mm.

A small yellowish brown species that is very variable both in size and coloration. The head is brown, except for a pair of yellow lines that extend between the ocelli and the eyes. Antennæ brown including the basal aspect. Palpi brown.

Prothorax broad, narrower to rearward, its disc brownish with a median longitudinal yellowish band, and sometimes with touches of yellow upon the middle of the side margins. Wings tawny, subhyaline, with brown veins. Legs yellow with blackish knee caps and a brownish wash externally covering tarsi, tibiæ (except in the middle), and the apical third of the femora.

Abdomen brownish. Tails pale yellowish brown. The ninth ventral segment of the male is similar in form to that of the other known males of this genus, but it entirely lacks the ventral percussion disc or hammer. Our figure (Fig. 8) shows the extended penis and one of its pair of tenacula more enlarged. The tips of the genital hooks formed by the up-curving genital plates are obtusely pointed (Fig. 8A). The subgenital plate of the female is squarely truncated, with a small notch in the middle of its apical margin (Fig. 8B).

We have specimens of this species from Rio Santa Ana, British Honduras, collected by Karl P. Schmidt, and there are numerous specimens of both sexes in the Godman collection from localities as follows:

Guatemala	Country?
Guatemala City, 2 ♀ s	V. de Chiriqui, 2 ♂ s and 1 ♀
San Geronimo, ♂ and ♀	(Champion)
Zapote, 3 ♀ s	El Zumbador, ♀ (Cham-
Brazil	pion)
Chapada, ♂	
Mexico	
Atoyae, ♀	
Pancina, ♂	
Teapa, ♂ and ♀	
San Juan, Vera Paz, ♀	

The obscure *Perla litura* of Pictet may possibly be a synonym of this species.

The nymph of Anacroneuria

We have no reared specimens of any species of this genus, but we have nymphs that undoubtedly belong to it from E. B. Williamson collected in Guatemala and from J. T. Lloyd, collected in Colombia. These have but two ocelli, and the venation of the developing wings shows the peculiar bending and pectinate branching of the second anal vein that is distinctive of the genus. We figure one of the Colombian nymphs herewith (Figs. 10A to E) and hereto add a brief description:

Length 9 to 14 mm.; antennæ $6\frac{1}{2}$ to 10 mm., and tails 8 to 13 mm. additional.

Body depressed, rather smooth except for dense fringes of hairs along the tibiæ externally. Head trapezoidal, truncate in front, widest behind the eyes where there is a low transverse carina covering the hind angles. Antenna long, yellowish, composed of numberless close-set rings beyond the three enlarged basal segments; these rings become again longer toward the tip. Ocelli two, small, set squarely between the eyes. The mouth parts are as shown in Figs. 10B, C, D, and F.

Prothorax twice as wide as long, narrower to rearward, straightish on the front border, rounded on sides and at rear and on all angles. An obscure pattern of brownish lines on either side of the pale median area traverses the disc lengthwise. The remainder of thorax and abdomen is concolorous, pale brownish (perhaps, greenish in life). There is a transverse black dash across each femur just before the knee.

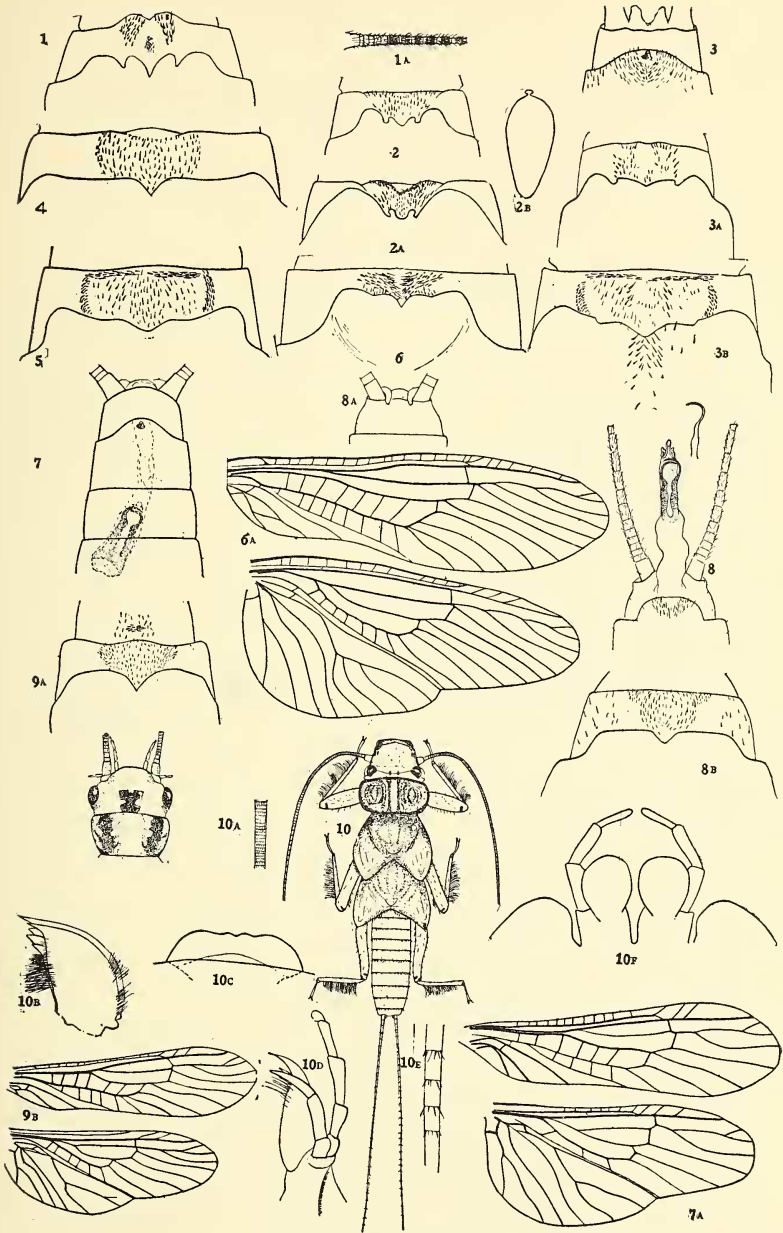
The yellowish tails are longer than the abdomen, their segments are longer than wide and each bears a circlet of stiff spinules around its apical border.

EGGS. We have examined the eggs of all the species of which we have had females, and with slight variations in size and taper, they conform to the type shown in our figure for *A. sulana* (Fig. 2B): all are oval with a low micropylar cap applied button-like to the broader end.*

* An *Anacroneuria* egg figure accidentally slipped into plate 6 (figure 10) of Needham & Claassen's "Monograph of the Plecoptera of North America." An undeterminable fragment of a single specimen of some member of this genus has since been found among some material from Texas, so that this genus should probably be added to the United States fauna.

EXPLANATIONS OF PLATE XII

- Fig. 1. *A. annulicauda*, ♀ from Rio, Brazil; eighth and ninth segments, ventral view.
- Fig. 1A. *A. annulicauda*, tail.
- Fig. 2. *A. sulana*, ♀ from Rio Santa Ana, Honduras.
- Fig. 2A. *A. sulana*, ♀ from Paso del Macho.
- Fig. 2B. *A. sulana*, egg.
- Fig. 3. *A. nigrocincta*, ♂ ventral view of end of abdomen.
- Fig. 3A. *A. nigrocincta*, ♀ from Chapada.
- Fig. 3B. *A. nigrocincta*, ♀ from Zapote.
- Fig. 4. *A. cincta*, ♀ from Val. de Chiriqui.
- Fig. 5. *A. aethiops*, ♀ from Chiapas, Mexico.
- Fig. 6. *A. naomi*, ♀ from Senahu, Vera Paz.
- Fig. 6A. *A. naomi*, wings.
- Fig. 7. *A. coronata*, ♂ from Mexico; ventral view with penis indrawn.
- Fig. 7A. *A. coronata*, wings.
- Fig. 8. *A. dilaticollis*, ♂ ventral view with penis extruded and tenaculum detached.
- Fig. 8A. *A. dilaticollis*, ♂ dorsal view showing genital hooks.
- Fig. 8B. *A. dilaticollis*, ♀ from Val. de Chiriqui.
- Fig. 9. *A. blanda*, ♀, head and prothorax; from Barro Colorado Island.
- Fig. 9A. *A. blanda*, sub-genital plate of ♀.
- Fig. 9B. *A. blanda*, wings.
- Fig. 10. *Anacroneuria* sp., nymph from Colombia.
- Fig. 10A. *Anacroneuria* sp., antenna.
- Fig. 10B. *Anacroneuria* sp., mandible.
- Fig. 10C. *Anacroneuria* sp., labrum.
- Fig. 10D. *Anacroneuria* sp., maxilla.
- Fig. 10E. *Anacroneuria* sp., tail.
- Fig. 10F. *Anacroneuria* sp., labium.



ANACRONEURIA